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USING ORGANIC LIGHT EMITTING DIODES (OLEDs) IN LANDSCAPE LIGHTING APPLICATIONS

FIELD OF THE INVENTION

[0001] This invention relates to a lighting assembly, and more particularly to low voltage solar technology platforms for lighting applications.

BACKGROUND OF THE INVENTION

[0002] Presently, landscape lighting systems, and backlighting systems for signage, fall into one of two technology platforms. The first type is a low voltage system which includes a central step-down transformer unit that converts standard 120 VAC, 60 Hz power line input into a 12 volt signal. The transformer powers a series of lamp nodes that are wired in parallel to a central supply wire. The supply wire is typically buried in the ground. In some instances, a standard electromagnetic transformer merely steps the input voltage down while maintaining the same frequency. Other low voltage systems use an electronic transformer that not only steps the input voltage down to the desired 12 VAC operating range, but significantly increases the frequency (e.g., 50 KHz). Still other systems use an AC-DC converter to step the input voltage down to a 12 VDC signal. Thus, although an electromagnetic transformer is low cost, it has low efficiency, large size and increased weight. The electronic transformer, on the other hand, has a high cost, a medium efficiency, and a reduced size and weight. Last, the AC-DC converter is approximately medium cost with a high efficiency, but is of medium size and weight. These low voltage systems are summarized below:

[0003]

Type	**Cost**	**Efficiency**	**Size/Weight**
Electromagentic	low	low	high
Electronic	high	mid	low
AC-DC	mid	high	mid

[0004] Both low voltage systems use halogen/incandescent and fluorescent light sources.

[0005] The second type of system is based on solar technology. These systems include stand alone units that are mounted in the ground, i.e., no wiring is required. Each unit is self-contained and includes a photovoltaic panel, rechargeable battery, driver circuit, and a light source (typically one or more LEDs or a fluorescent tube). In sunlight, the drive circuit and light source are disabled via a light sensor, while the photovoltaic panel provides recharging energy or current to the battery. Ultimately, the battery reaches its charge capacity. When ambient light falls below a predetermined threshold level, the drive circuit is enabled and the light source is powered. The drive circuit includes an ambient light level detector that interfaces with the light source supply circuit.

[0006] Typically, these light sources are driven by a DC or pulse-width modulated topology. The DC-type is low cost and has a high efficency. When driving an LED light source, though, the DC-type drive circuit has a low spectral efficiency and only a medium LED life. A pulse width modulated system, on the other hand, has a high cost and low efficiency, even though it results in high spectral efficiency and increased LED life. Thus, solar systems often use LED and fluorescent light sources because of the efficiency results. In addition, the size of the photovoltaic panels and the number of rechargeable batteries must also be minimized to provide a small profile. Thus, efficient light sources that extend the overall ON time are preferred.

[0007] Light sources typically used in landscape lighting applications include fluorescent, halogen/incandescent, and LEDs. Although halogen/incandescent light sources are low cost, they require high input power providing a high range of light output, and have a low spectral efficiency and low life expectancy. LEDs, on the other hand, are of medium cost and require a low input power. Even though LEDs have an extended life, the light output is low and the spectral efficiency is only rated at a medium level. Fluorescent light sources have a high cost associated therewith, and a medium range of input power resulting in high light output, high spectral efficiency, but only a medium life.

[0008] In addition, fluorescent light sources often require complex drive circuit (ball) and perform poorly at low temperatures.

[0009] Thus, a need exists for improvements in low voltage and solar technology platforms for landscape and back lighting uses that address cost, input power, light output, spectral efficiency, life, shape, and color options.

SUMMARY OF THE INVENTION

[0010] An improved lighting assembly includes a housing that receives an organic light emitting diode (OLED) light source and a power source for the OLED. A light transmissive portion of the housing permits light from the OLED to pass therethrough.

[0011] An optional diffuser interposed between the light source and the light transmissive portion of the housing diffuses the light for the end use.

[0012] In selected applications the light source uses a photovoltaic panel generating electrical energy from ambient light.

[0013] A reflector may also be incorporated into the assembly to direct light from the OLED through the diffuser.

[0014] Clearly, an OLED light source provides for low cost, low input power, high light output, high spectral efficiency, and an increased life, while also permitting the OLED to be conformed to various shapes and provide different color options.

[0015] Still other features and benefits will become apparent upon reading the following detailed description.

BRIEF DESCRIPTION OF DRAWINGS

[0016] Figure 1 is an elevational view of a first preferred embodiment of an area landscape light assembly.

[0017] Figure 2 is a second preferred embodiment of area landscape light assembly.

[0018] Figure 3 is a third preferred embodiment of area landscape light assembly.

[0019] Figure 4 shows a preferred directional landscape light assembly.

DETAILED DESCRIPTION OF THE INVENTION

[0020] Figure 1 illustrates a light assembly **10** particularly used for area landscape lighting. A housing **12** includes a light transmissive or clear lens portion **14** and a circuit housing portion **16**. Typically, the light transmissive portion is a hollow chamber formed of a transparent plastic or similar material and may include a diffuser **18**. Here, the diffuser **18** is disposed along a lower planar surface of the housing so that light emanating from the light source is generally evenly spread over the ground surface. The light source **30** is an organic light emitting diode (OLED). The OLED is preferably located at the other end of the transparent housing portion, particularly, the OLED is secured to a lower surface or underside of the circuit housing.

[0021] A power source is housed within the housing and is preferably an electronic transformer that receives electrical energy from a photovoltaic panel **32**. One or more panels may be provided on an upper surface of the circuit housing portion where they are exposed to sunlight and provide electrical energy for recharging a battery associated with the power supply. In addition, a light sensor **34** disconnects the power source/battery from the OLED during daylight and allows the OLED to be powered during low ambient light conditions. A hanging element such as loop or ring **40** is provided on the housing so that it may be hung from a support member such as a shepherd's crook **42**.

[0022] Figures 2 and 3 illustrate the preferred area landscape light assemblies that have many of the features described in association with Figure 1. Accordingly, like reference numerals will refer to like components and new reference numerals will identify new components. In Figure 2, diffuser **50** is a substantially hollow cylinder that extends within the transparent housing portion from a first or upper end adjacent the OLED light source **30** to a second or lower end. Also received within the transparent housing portion, and particularly within the diffuser, is a reflector **52**. The reflector directs light emanating from the OLED to a desired output direction. In this embodiment, the reflector directs light from the OLED radially outward through the diffuser and ultimately through the transparent

housing portion. A base **54** allows the light assembly to be set on a planar surface and handle **56** permits the light assembly to be transported like a lantern.

[0023] In the preferred embodiment of Figure 3 the same diffuser and reflector assembly as described with respect to Figure 2 is used. However, since it is not desired that light be directed through a bottom surface of the transparent housing portion, a mounting stake **60** supports a lower surface **62** of the housing. This allows the upper surface of the circuit housing to receive an enlarged photovoltaic panel **64** thereon.

[0024] It will also be appreciated that although photovoltaic versions of the OLED landscape light assembly are illustrated, removal of the panels and substitution of wiring interconnecting the light assembly with an external power source could also be used.

[0025] In Figure 4 a preferred directional landscape light assembly is shown. Housing **112** encloses an OLED light source **130** and directs light through a protective lens **170**. The direction of the housing may be varied through an angle socket joint **172**, such as a ball socket, that allows selective orientation of the light source housing **112** relative to the circuit housing **116**. Photovoltaic panels **132** are disposed along the circuit housing and oriented to maximize receipt of the sunlight. A stake extends from a lower portion of the circuit housing to secure the light assembly in place.

[0026] OLEDs have a major advantage over other lighting sources in that OLEDs can be fabricated into flexible, thin-film sheets. These sheets are used to create unique shapes and mounting methods for light emitting surfaces. This, in turn, reduces the need for diffusers and light guides that typically are used in incandescent, fluorescent, and LED outdoor lighting products. The OLEDs are ~~be~~ designed to supply light output comparable to either LEDs or halogen/incandescent systems. Thus, for low light output applications (ambient or area lighting), a solar technology system can be used. Conversely, for high light output applications (directional lighting), a low voltage driving system can be used (Figure 4). Thus, integrating OLEDs into landscape lighting applications provides a low cost, low input power assembly that has a high light output rating, along with a high

spectral efficiency and extended life expectancy. The ability to shape the OLED also offers many advantages over the known light sources.

[0027] In addition, color options are viable alternatives and may be used to create pixel displays leading to light emitting OLED panels with multi-color capability. In such an arrangement, a microcontroller drives the OLED pixel elements in a manner to vary color in a predetermined fashion for coloring effects, such as holiday lighting.

[0028] The invention has been described with reference to an illustrative embodiment. Obviously, modifications and alterations will occur to others upon reading and understanding of the preceding detailed description. It is intended that the invention be construed as including all such alterations and modifications insofar as they come within the scope of the appended claims or the equivalents thereof.